

Remarks

Claims 1-33 are in the case.

Basis for the amendment of claim 1 is found at [0021] of the published application.

We turn now to the rejections.

Claims 1-33 are rejected under 35 U.S.C 112 first paragraph on the basis that “0.01 to 10 liter per min per  $\text{cm}^2$  anode or cathode area” does not meet the description requirement. Claim 1 is amended to recite 0.0001 instead of 0.01. Reconsideration is requested.

Claim 1-33 are rejected under 35 U.S.C 112, first paragraph, on the basis the recitation of “in the range of 1 to 750 milliliter per min per applied Ampere average current” in claim 31 and “in the range of 1 to 750 ml solution per min per applied Ampere average current” in claim 31 does not meet the description requirement. The two phrases are cancelled from the claims. In addition, claim 9 is canceled herewith. Reconsideration is requested.

We turn now to the prior art rejections.

Claims 1-12, 15, 17, 27-31 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Erb et al, in view of Lowenheim additionally in view of Biberbach et al. and Gonzalez et al. Claims 16, 18-25 and 32 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Erb et al. in view of Lowenheim and additionally in view Biberbach et al and Gonzalez et al. and further in view of admitted prior art. Claim 13 and 14 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Erb et al. in view

of Lowenheim additionally in view of Biberbach et al. and Gonzalez et al. and in further view of Uzoh et al. Claim 26 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Erb et al. in view of Lowenheim, in view Biberbach et al, Gonzalez et al and admitted prior art and further in view of Hutkin.

Reconsideration of all four prior art rejections is requested on the basis that the rejections do not comply with the USPTO guidelines for Determining Obviousness under 35 U.S.C. 103 in view of the Supreme Court Decision in KSR International Co. v. Teleflex, Inc. The rationate set forth in said Guidelines that is relied on for the rejections appears to be "Combining Prior Art Elements According to known Methods to Yield Predictable Results". For this the Guidelines require "a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being lack of actual combination of the elements in a single piece of prior art." In particular, the rejection art combinations fail to provide any recitation of agitation rate normalized to electrode area ("agitation rate of 0.0001 to 10 liter per min per  $\text{cm}^2$  anode or cathode area" is recited in independent claims 1, 31 and 33). The action seems to take the position that the "stirring" in Erb and the convective movement of Lowenheim are the same as agitation rate normalized to electrode area. The stirring of Erb and Lowenheim deals with the uniformity of the bulk electrolyte, i.e. electrolyte turnovers required to remove any concentration gradients in the bath and is independent of the size of the electrode(s) employed, whereas the agitation rate normalized for electrode area concerns itself with the electrolyte flow in close proximity to the electrode surface and scaling to the size of the electrode surface area. Paragraph 8 of the Erb declaration submitted herewith shows that the stirring of Erb is different from the agitation rate normalized to electrode area as

claimed. The words of Lowenheim nowhere support interpretation of convective movement mentioned therein to be agitation rate normalized to electrode area.

Reconsideration of the four prior art rejections is also requested on the basis that the applied prior art combinations do not make obvious that grain refinement is achieved by the high deposition rates (at least 0.05mm/hr) acting in concert with the electrode area normalized agitation/flow rates as recited in independent claims 1, 31 and 33. As indicated above, the applied prior art combinations do not teach electrode area normalized agitation/flow rates at all. Rather Erb teaches stirring of electrolyte which is to remove concentration gradients and temperature gradients in the electrolyte (See paragraph 7 of the enclosed Erb declaration). Rather Lowenheim teaches convective movement in electrolyte bath to stop stratification (denser solution at the bottom and lighter at the top). Both Erb and Lowenheim teach mixing of electrolyte bath so that it is or remains of uniform composition and temperature. On the other hand, the agitation/flow rate normalized to electrode area of the claims is to provide in concert with high deposition rate the occurrence of grain refinement. Biberbach et al and Gonzalez et al. are applied as teaching high deposition rates are provided by high agitation rates but nothing is said about agitation/flow rates normalized to electrode area or the combination of this with high deposition rates as an independently considered parameter providing any benefit or that high deposition rates acting in concert with electrode area normalized flow rates provide control parameters for grain refinement. Rather the purpose of mixing in Erb and Lowenheim is to maintain uniform electrolyte composition. In Biberbach agitation rate is not related to deposition rate. Biberbach doesn't even mention any agitation rate. Rather "movement of the bath" which apparently is caused by article movement is mentioned and is not related to agitation rate and agitation rate normalized

to electrode area is nowhere mentioned. In Biberbach and Gonzalez deposition rate is not related to agitation, i.e. deposition rate and agitation are interdependent. That is not what the independent claims here embrace. Rather in the claims here deposition rate and electrode area normalized agitation/flow rate are con-functional.

To illustrate the difference between mixing as in Erb and Lowenheim to provide electrolyte bath uniformity and electrode area normalized agitation rate/high deposition rate in the independent claims herein, a copy Qiao, G. et al. Electrochemical Acta 51, 85-92 (2005) is submitted herewith.

Figure 1 of Qiao shows his set up which includes a bulk electrolyte tank (16) where electrolyte is mixed (pumped in via (5) and out via (9)) and heated. This is where the Erb and Lowenheim mixing takes place. On the other hand, electroplating takes place in (4) where electrolyte is pumped at high speeds across the cathode. This is surface electrode flow and is equivalent to the claimed electrode area normalized agitation rate and affects the microstructure. Please note page 89, paragraph 3.2.2 and Figures 7 and 8 of Qiao. Figure 7 shows increasing cathodic current densities (=high deposition rates) results in grain size reduction (while employing DC plating). Figure 8 shows increasing electrode surface flow decreases grain size and the beneficial effect of high flow at the cathode surface where reduction reaction occurs. Qiao provides clear evidence that electrolyte mixing to achieve uniform ion concentration and temperature throughout the electrolyte bath is different from surface flow and demonstrates that a uniform (well mixed) electrolyte and electrode surface normalized agitation/flow are distinct parameters with different effects.

We turn now to the instant patent application. Figure 1 shows a drum plater and bulk electrolyte (2) when mixed is separate from cathode (3)/anode 5 surface where the

plating takes place [0041]. Note Figure 2 which shows a brush plater with the workpiece (cathode 6) receiving electrolyte via flow channels in the anode (3). Note that electrolyte solution is provided from a tank (not shown) [0042] where mixing/temperature takes place to remove concentration and temperature gradients.

In summary the mixing provided by Erb and Lowenheim is a different parameter from electrode area normalized flow rate as claimed and Biberbach et al and Gonzalez et al. show no effect of any parameter on grain refinement or any co-functional effect of agitation and deposition rate. What is happening in the claims is a surface phenomenon rather than a mixing result.

Allowance is requested.

Respectfully submitted,

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